

# ANALYSIS OF AERIAL IMAGES TO PROTECT MARINE ECOSYSTEMS

## “DETECTION AND CLASSIFICATION”

ALIREZA FOROUTAN TORKAMAN

M1 COMPUTER SCIENCE (ARTIFICIAL INTELLIGENCE)

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# AGENDA

- Introduction
- Researches
- Data Preparation
- Training Strategies
- Identification
- Visualization
- Data Analysis
- User Interface
- Model Evaluation and Progress
- Challenges
- Results and Discussion
- Conclusion

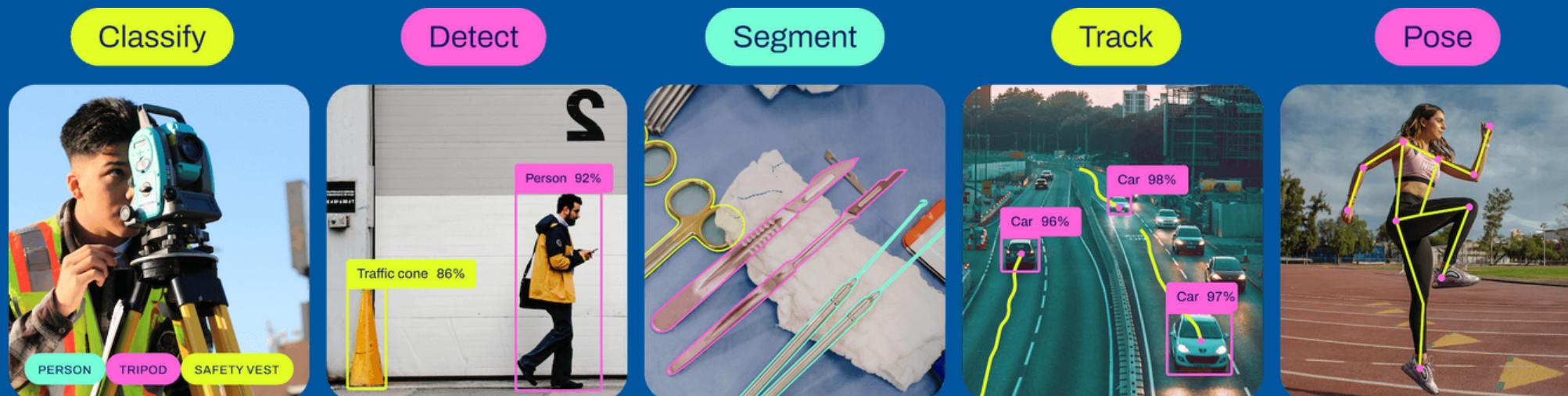
# INTRODUCTION

- Boat detection and classification in Lérins Islands using AI
- Visualization
- Data analysis



# RESEARCHES AND MODEL SELECTION

- Selection and training
- YOLOv8, a machine learning model architecture



# DATA PREPARATION

# Source of the database - drone images of Lérins Islands

- Relevance and Accuracy
- 150 images / 90 degree angle



Image taken of the area by drone

## Image annotation (Label Studio)



Example of image annotation process

# Data augmentation do to limited initial datasets

- Accuracy and reliability
- Augmentor.py file
- 360 images



Original image



Horizontal flip



Vertical flip

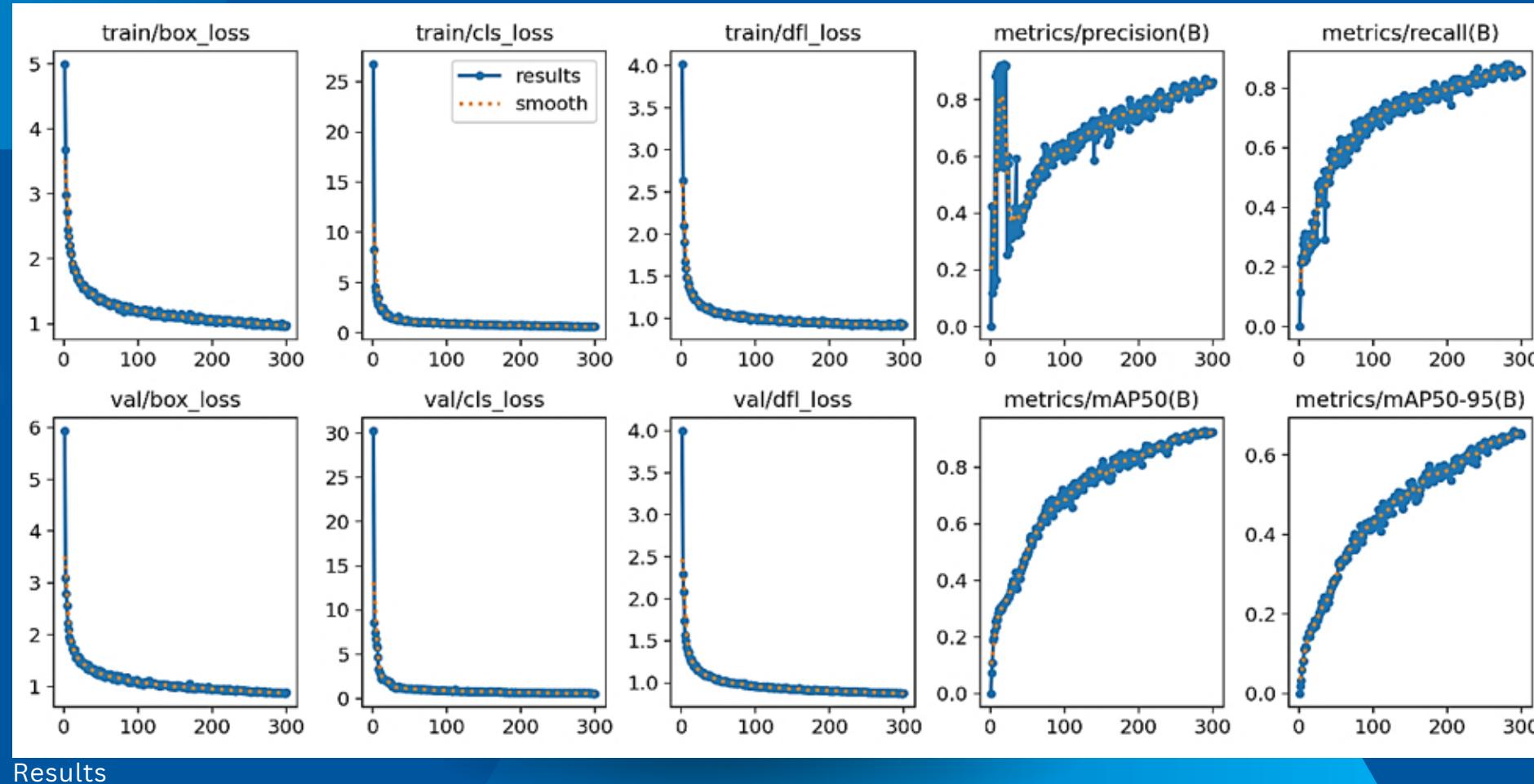
# TRAINING AND EVALUATION

# TRAINING

- `main.py`
- **Fine-tuning parameters**
- **Performance graphs and final trained model**

# Performance of models through evaluation metrics

More than 80% precision



# IDENTIFICATION



Predicted boats

# AREA CALCULATION

## A dual approach:

- **Area\_boxes() & Area\_pixels()**
- **GSD & Image metadata**

```
# Calculate Ground Sample Distance (GSD)
gsd_x = (sensor_width * altitude) / (focal_length * imgsize[0])
gsd_y = (sensor_height * altitude) / (focal_length * imgsize[1])
```

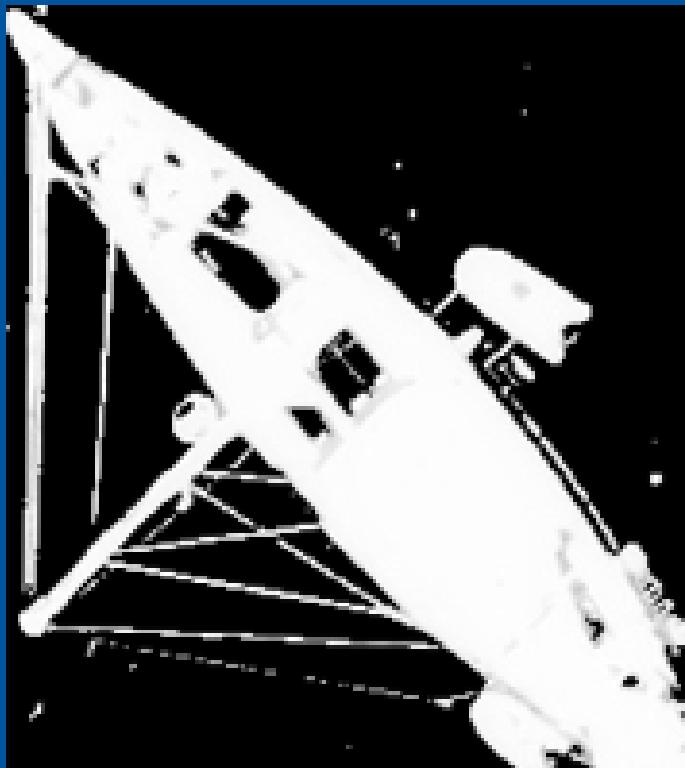
## **Area\_boxes()**

**pixel coordinates of the bounding box**



# Area\_pixels()

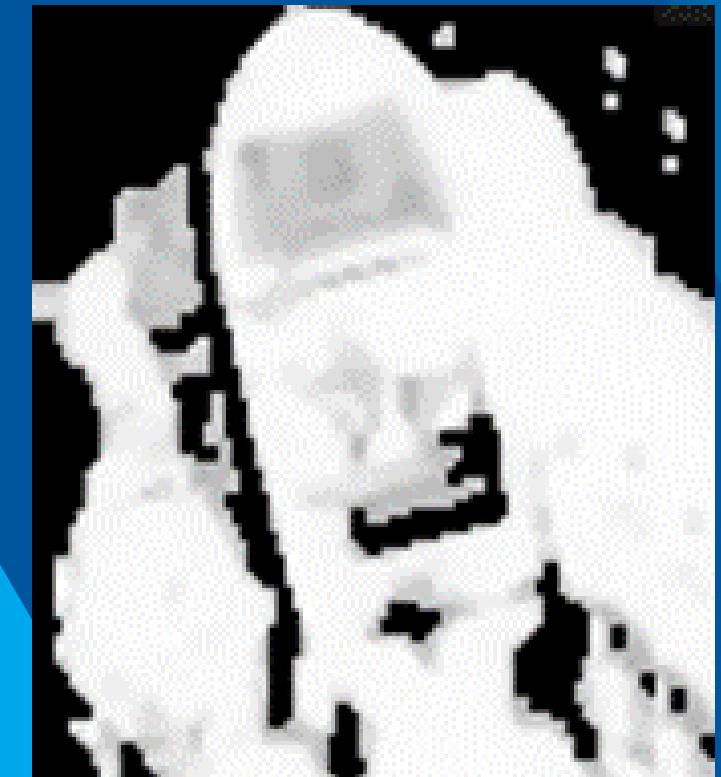
## Morphological Processing



Morphological result on a sailing boat



Morphological result on a motor boat



Morphological result on a moving boat

## Advantages and Drawbacks



Aerial image captured at 2:00 p.m.



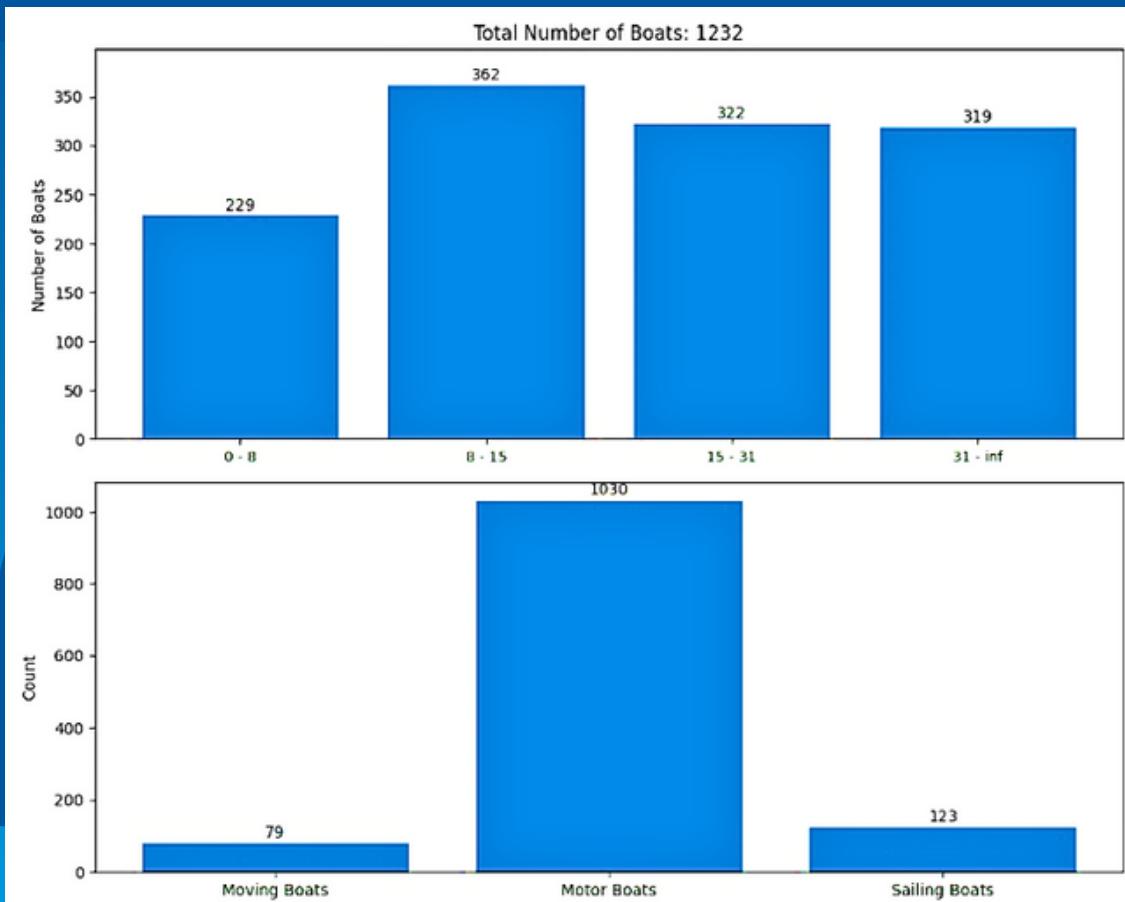
Boat in a shiny background



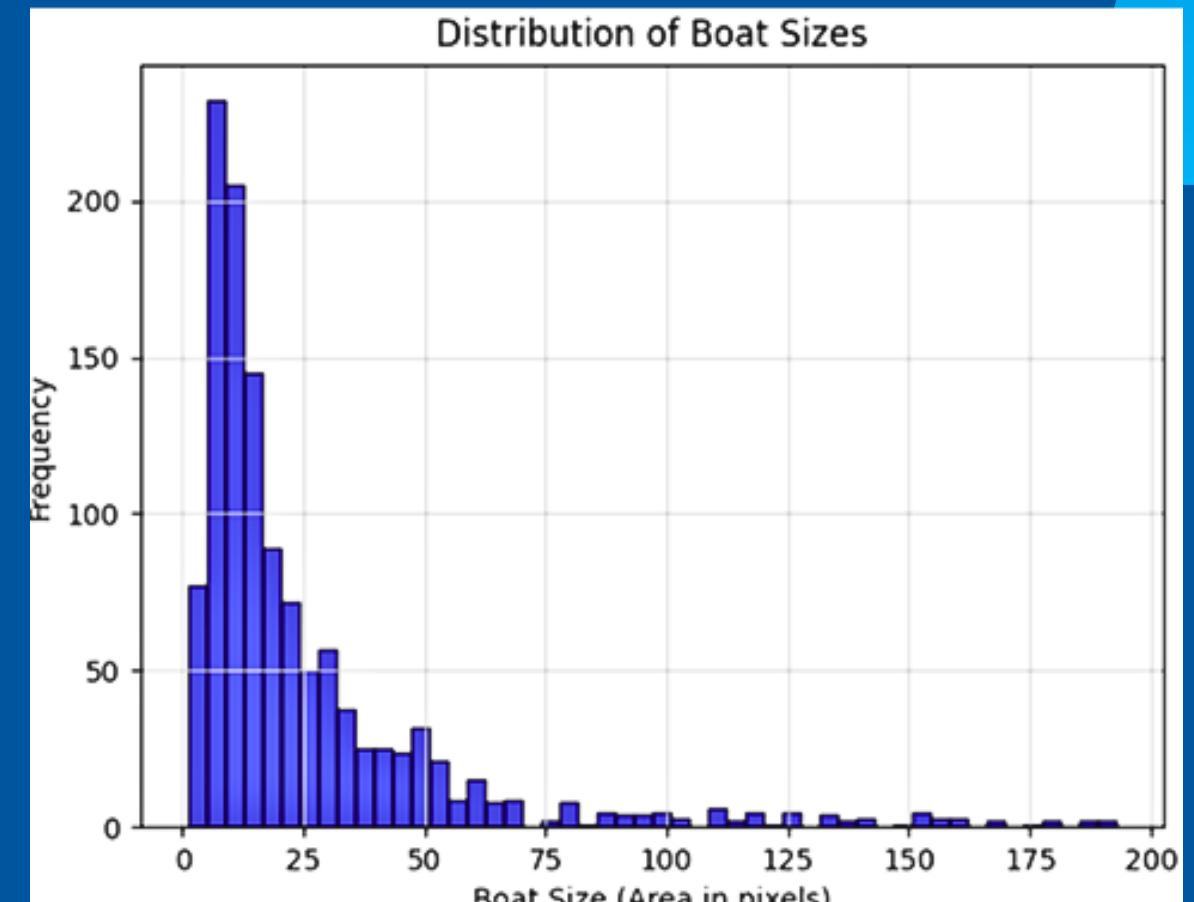
# DATA ANALYSIS

- Results\_and\_Statistics.py
- Categorizing based on Size distribution
- Setting Class interval thresholds
- Options
- Plots
- Class\_intervals.txt

# Visualization in understanding boat distribution



Statistic chart example



Distribution chart example

# USER INTERFACE

- Run.py
- User choices for area calculation
- Setting class intervals based on collective area or image-specific areas
- Flexibility in adapting to different datasets

Calculate the area using:

- 1) Pixels
- 2) boxes

Your chois: 1

Determining intervals using:

- 1) Database images
- 2) Current input

Your chois: 1

Are you using a new dataset?(Y/N) N

# VISUALIZATION



Visualized sample

# Model Evaluation and Progress

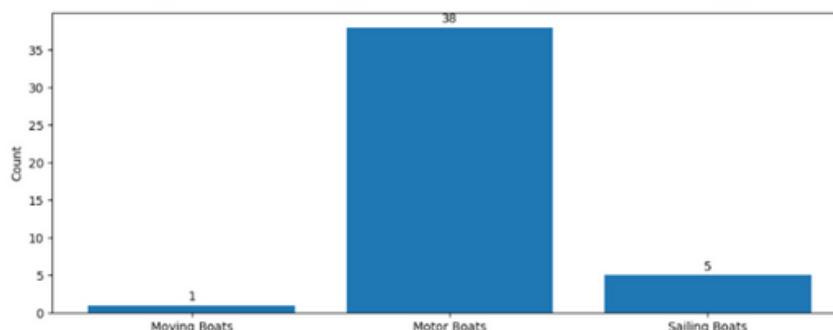
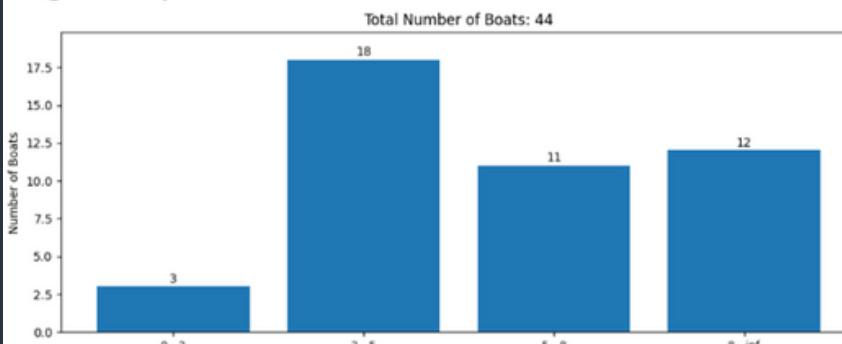


chart 20 performance of the first model

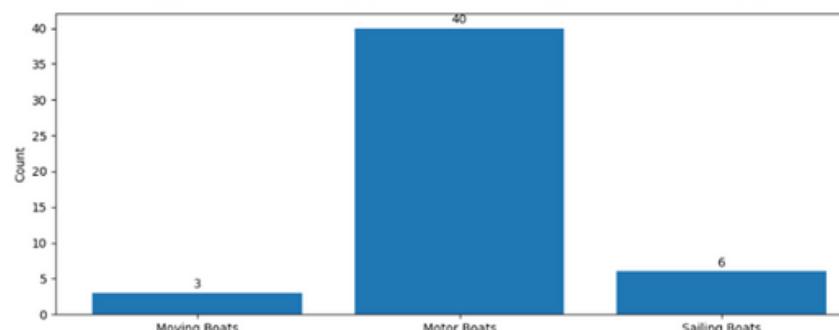
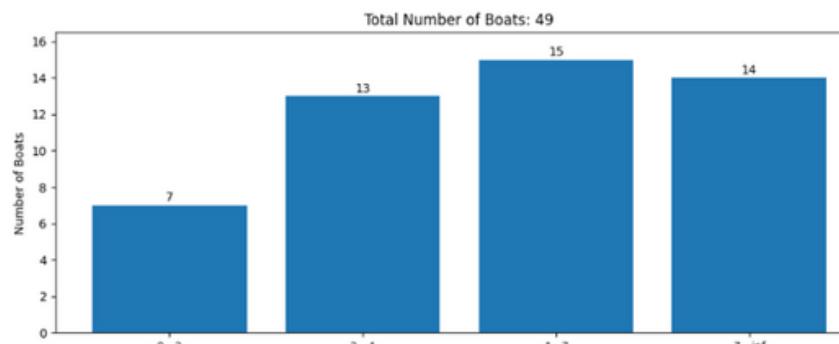
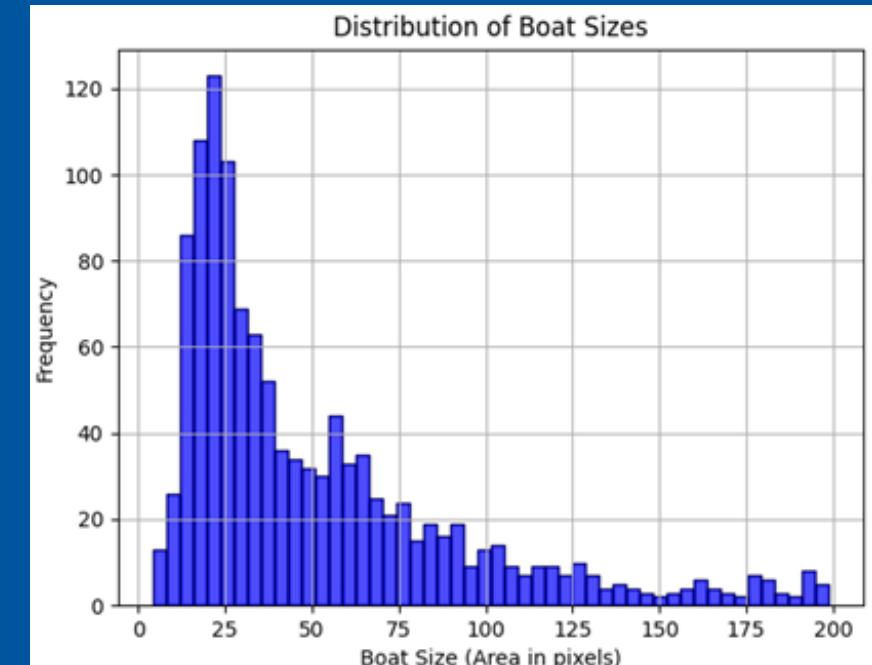
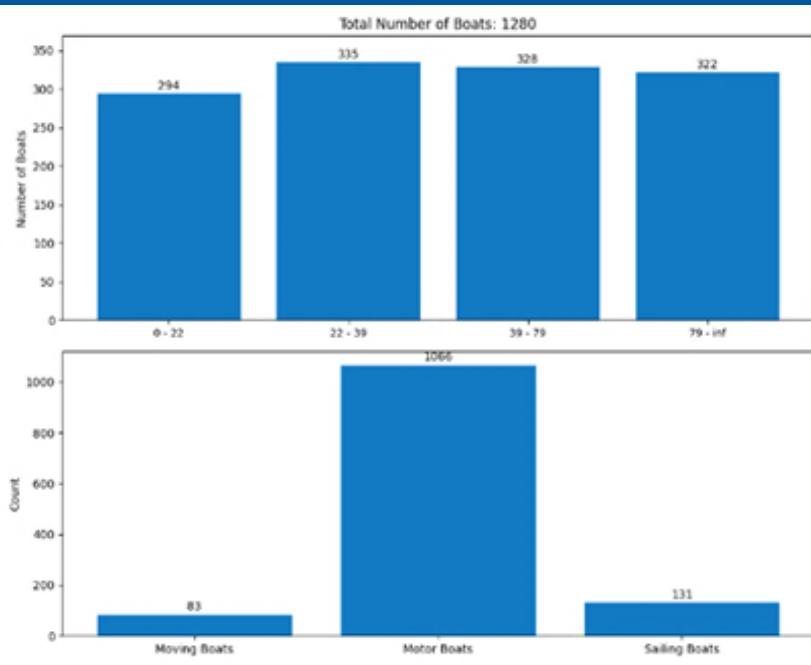


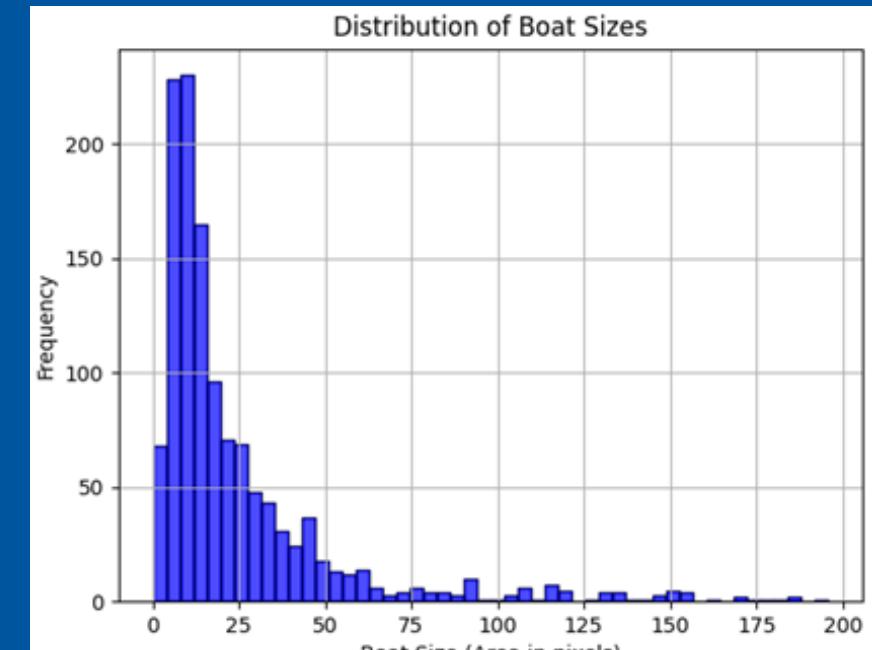
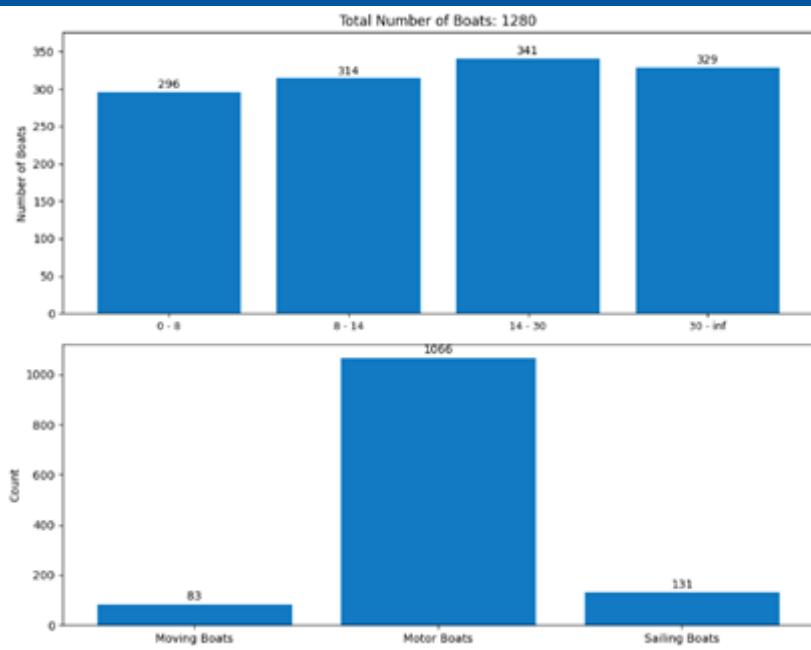
chart 16 performance of the second model

# RESULTS AND DISCUSSION

Statistics for all boats in the dataset revealed by Bounding Box Areas:



Statistics for all boats in the dataset revealed by counting pixels:



# CHALLENGES

- Technical issues, including hardware limitations and data labeling
- Overcoming challenges
- Interdisciplinary nature of the project

# CONCLUSION

- The success of the project in boat detection and classification
- Practical implications for marine students and environmental surveillance
- Continuous refinement and application in real-world scenarios
- Experiences

# References

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